

ECE 343: Signals and Systems

Homework 1: Complex Arithmetic

1. Text B.2.
2. Text B.3.
3. Text B.6.
4. Text B.11.
5. COMMUTATION OF CONJUGATION. Show that the complex conjugation operation commutes with addition, multiplication, and exponentiation.
 - (a) $(a + b)^* = a^* + b^*$
 - (b) $(ab)^* = a^*b^*$
 - (c) $\exp(a)^* = \exp(a^*)$
6. COMPLEX POWERS. Write the following in rectangular form. If the power is multivalued, show *all* of the values.
 - (a) j^j
 - (b) 1^j
 - (c) j^0
 - (d) \sqrt{j}
7. POLARIZATION IDENTITY. Show that the identity

$$ab^* = \frac{1}{4} (|a + b|^2 + j|a + jb|^2 + j^2|a + j^2b|^2 + j^3|a + j^3b|^2)$$

holds for all complex numbers a and b . *Hint: try to rewrite the modulus of a sum $|a + b|^2$ as a sum of moduli (and other terms), without decomposing into real and imaginary parts. Problem B.6 will be helpful too.*